100758

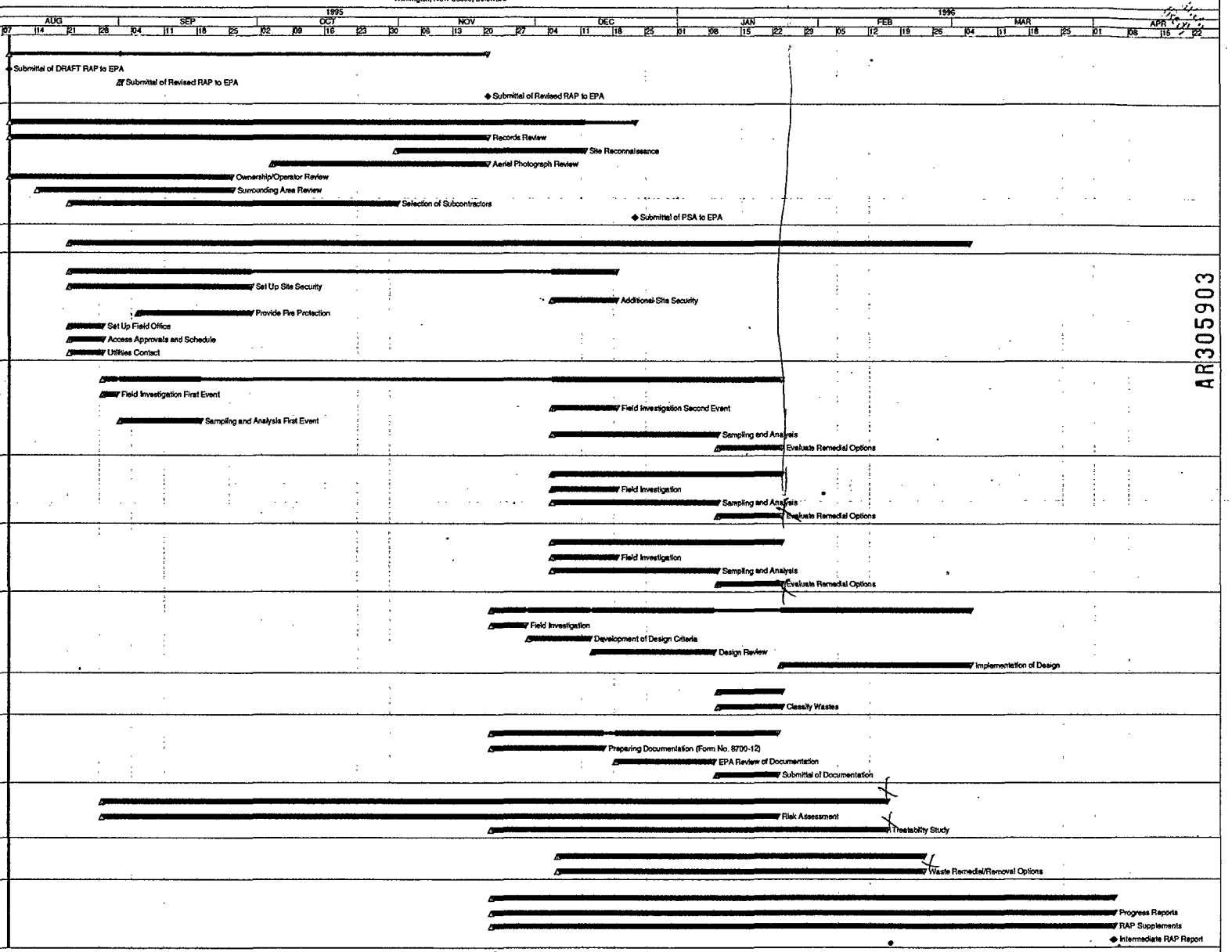
APPENDIX D

PROJECT SCHEDULE

PROJECT SCHEDULE
Halby Chemical Superfund Site
Wilmington, New Castle, Delaware

Revision #2
20 November 1995

Act ID	Description	Start	Finish
SUBMISSION OF RAP			
		08AUG95	20NOV95
1140	Submittal of DRAFT RAP to EPA	08AUG95	
1141	Submittal of Revised RAP to EPA	01SEP95	01SEP95
1142	Submittal of Revised RAP to EPA		20NOV95
PRELIMINARY SITE ASSESSMENT			
		08AUG95	22DEC95
1000	Records Review	08AUG95	20NOV95
1010	Site Reconnaissance	31OCT95	11DEC95
1020	Aerial Photograph Review	04OCT95	20NOV95
1030	Ownership/Operator Review	08AUG95	25SEP95
1040	Surrounding Area Review	14AUG95	25SEP95
1080	Selection of Subcontractors	21AUG95	31OCT95
1085	Submittal of PSA to EPA		22DEC95
WORK PLAN ACTIVITIES			
		21AUG95	04MAR96
SITE MOBILIZATION AND SECURITY			
		21AUG95	18DEC95
1090	Set Up Site Security	21AUG95	29SEP95
1095	Additional Site Security	04DEC95	18DEC95
1100	Provide Fire Protection	05SEP95	29SEP95
1110	Set Up Field Office	21AUG95	28AUG95
1120	Access Approvals and Schedule	21AUG95	28AUG95
1125	Utilities Contact	21AUG95	28AUG95
INVESTIGATION OF WATER MAIN			
		28AUG95	23JAN96
1130	Field Investigation First Event	28AUG95	31AUG95
1135	Field Investigation Second Event	04DEC95	18DEC95
1145	Sampling and Analysis First Event	01SEP95	18SEP95
1150	Sampling and Analysis	04DEC95	09JAN96
1160	Evaluate Remedial Options	09JAN96	23JAN96
DRAINAGE DITCH DELINEATION			
		04DEC95	23JAN96
1200	Field Investigation	04DEC95	18DEC95
1210	Sampling and Analysis	04DEC95	09JAN96
1220	Evaluate Remedial Options	09JAN96	23JAN96
SUMP AREA DELINEATION			
		04DEC95	23JAN96
1460	Field Investigation	04DEC95	18DEC95
1470	Sampling and Analysis	04DEC95	09JAN96
1480	Evaluate Remedial Options	09JAN96	23JAN96
STORMWATER AND OTHER WATER CONTROLS			
		21NOV95	04MAR96
1250	Field Investigation	21NOV95	28NOV95
1260	Development of Design Criteria	29NOV95	12DEC95
1270	Design Review	13DEC95	09JAN96
1280	Implementation of Design	23JAN96	04MAR96
WASTE CLASSIFICATION			
		09JAN96	23JAN96
1290	Classify Wastes	09JAN96	23JAN96
PROCESSING AN EPA IDENTIFICATION NUMBER			
		21NOV95	22JAN96
1300	Preparing Documentation (Form No. 8700-12)	21NOV95	15DEC95
1305	EPA Review of Documentation	18DEC95	08JAN96
1310	Submittal of Documentation	09JAN96	22JAN96
REMEDIAL OPTIONS AND RISK ASSESSMENT			
		28AUG95	15FEB96
1320	Risk Assessment	28AUG95	22JAN96
1330	Treatability Study	21NOV95	15FEB96
WASTE REMEDIAL/REMOVAL OPTIONS			
		05DEC95	23FEB96
1350	Waste Remedial/Removal Options	05DEC95	23FEB96
PROJECT REPORTING			
		21NOV95	04APR96
1360	Progress Reports	21NOV95	04APR96
1370	RAP Supplements	21NOV95	04APR96
1440	Intermediate RAP Report		04APR96



AR305903

APPENDIX E

ACCESS AGREEMENTS

PHILLIPS, GOLDMAN & SPENCE, P. A.
ATTORNEYS AT LAW
PENNSYLVANIA AVE. AND BROOM ST.
1200 N. BROOM STREET
WILMINGTON, DELAWARE 19806
(302) 655-4200

JOHN C. PHILLIPS, JR.
STEPHEN W. SPENCE
ROBERT D. GOLDMAN
ROBERT F. PHILLIPS
LISA C. MCLAUGHLIN
STEVEN K. KORTANEK
JAMES P. HALL

P.O. BOX 1710
WILMINGTON, DE 19899
TELECOPIER: (302) 655-4210

August 30, 1995

FAX COVER SHEET

TO: James Nortz, Esquire
Raj Vyas, Esquire
Witco Corporation
203-552-2869

Carole Sforza
Langan Engineering and Environmental Services
201-794-0366

Eric Newman
EPA
215-597-9890

FROM: John C. Phillips, Jr.

RE: Halby Site
F & H Transport, Inc.
Our File No. WITCO-7

Gentlemen:

Enclosed please find a fully-executed copy of the F & H Transport, Inc.'s Access Agreement regarding the Halby site. If you have any questions regarding same, please do not hesitate to contact me.

Very truly yours,

JOHN C. PHILLIPS, JR.

JCP:tlb
Enclosure
witco7.25

PHILLIPS, GOLDMAN & SPENCE, P. A.
ATTORNEYS AT LAW
PENNSYLVANIA AVE. AND BROOM ST.
1200 N. BROOM STREET
WILMINGTON, DELAWARE 19806
(302) 655-4200

JOHN C. PHILLIPS, JR.
STEPHEN W. SPENCE
ROBERT S. GOLDMAN
ROBERT F. PHILLIPS
LISA C. McLAUGHLIN
STEVEN K. KORTANEK
JAMES P. HALL

P.O. BOX 1710
WILMINGTON, DE 19899
TELECOPIER: (302) 655-4210

August 30, 1995

George H. Seitz, Esquire
Prickett, Jones, Elliot, Kristol & Schnee
1310 King Street
P.O. Box 1328
Wilmington, DE 19899

RE: Witco (Halby/F & H Transport, Inc.)
Our File No.: WITCO-7

Dear Butch:

Please find enclosed a copy of the fully executed Access Agreement between Witco and F & H Transport, Inc. Thank you for your assistance and cooperation in this matter.

Very truly yours,

JOHN C. PHILLIPS, JR.

JCP:tlb
Enclosure
cc: James Nortz, Esquire (w/enc.)
Witco Corporation

Carole Sforza (w/enc.)
Langan Engineering

Eric Newman (w/enc.)
EPA

witco7.25

LICENSE AND ACCESS AGREEMENT

THIS AGREEMENT is entered into by and among WITCO CORPORATION, and its respective officers, employees, agents and representatives, including contractors and subcontractors (herein referred to as "Permittee") and F&H TRANSPORT, INC. and its respective agents, employees, mortgagors and representatives (hereinafter referred to as "Owner").

WHEREAS, Permittee desires to enter upon and access Owner's property and easements at 520 Terminal Avenue, New Castle, Delaware, 19720, utilizing existing (as of the date of this Agreement) access roads thereto, (hereinafter referred to as "the Premises"), for the purposes of conducting all remedial design and remedial action-related activities including, without limitation, construction investigative activities (hereinafter the "Work") that may be required of the Permittee by the United States Environmental Protection Agency (USEPA), the State of Delaware, local regulatory agencies and any natural resources trustees, including without limitation, the United States Department of the Interior and the National Oceanic and Atmospheric Administration (collectively hereinafter the "Agencies").

WHEREAS, Owner desires to grant to Permittee and Agencies, their employees, agents, representatives, contractors and subcontractors, a non-exclusive, revocable license to enter and continued access to the Premises for the purposes of conducting the Work that may be required of the Permittee by the Agencies, subject to the terms and conditions set forth below.

NOW, THEREFORE, for and in consideration of the foregoing and the mutual covenants hereinafter made by the Parties to this Agreement, Owner hereby grants Permittee and Agencies, their employees, agents, representatives, contractors and subcontractors, a non-exclusive, revocable license to enter and continued access to the Premises, subject to the following terms and conditions:

1. Permission is granted to enter and access the Premises, 24-hours per day, solely for the purposes of conducting the Work that may be required by the Agencies, and for no other purpose.

2. Unless this Agreement is sooner terminated by Owner as a result of Permittee's default hereunder, this Agreement will remain in effect until the work that may be required of the Permittee, as well as any natural resource damage activities are completed to the satisfaction of the Agencies or other authorities. Permittee will provide copies of relevant correspondence and documents from the Agencies, provided, however, that Permittee may provide Owner with brief summaries of voluminous documents and will provide copies of such documents only upon request with regard to work actually performed on Owner's property as and when received by Permittee. Such materials shall remain confidential.

3. Owner hereby acknowledges that the Permittee is subject to the requirements of the Agencies as to design, timing, methodology, sequencing and implementation of the Work on the Premises. Subject to these requirements, Permittee shall use its best efforts, including efforts to sequence remedial activities, so as not to interfere with Owner's current operations, communications and other activities.

4. Neither party shall interfere with the Work being conducted by or on behalf of the other, including, without limitation, any personnel, equipment, utilities, fixtures, pipelines or facilities associated therewith. The Parties will store their equipment in a manner and location that is mutually agreed upon by the Parties, so as not to interfere with each other's business activities. Each party shall indemnify the other against any claims or causes of action for injury to any persons or property or for any monetary penalties incurred resulting from a party's failure to abide by this Paragraph.

5. If it is necessary to remove any fences to facilitate the Work to be performed by Permittee, they shall be removed and restored by Permittee, at its expense. All tools, equipment, material or other property placed or temporarily stored upon the Premises by the Permittee shall remain the property of the Permittee.

6. Nothing in this Agreement is intended to restrict or affect any rights, claims or causes of action existing or that may accrue under applicable law, judicial order an/or agreement that the Permittee or the Agencies may have in the Premises or against the Owner.

7. Except for the Agencies, this Agreement shall not inure to the benefit of any other third party not a party to this Agreement; it being agreed and acknowledged that the rights herein granted are personal to Permittee, but shall be binding upon the successors and assigns of Owner.

8. Owner shall inform all occupants, users, lessees, assigns, easement holders and other successors in interest in the Premises of the existence and requirements of this Agreement.

9. Permittee shall inform all contractors, employees, agents and representatives of the Permittee of the existence and requirements of this Agreement.

10. Owner represents and warrants that it is the lawful owner and occupant of the entire Premises and that the consent(s) of no other persons or entities are required to effectuate each provision of this Agreement.

11. Permittee represents and warrants that its undersigned representative is authorized to execute this Agreement and to bind the Permittee to the terms of this Agreement.

12. This Agreement will be governed by Delaware law.

13. No representations or warranties are made or have been relied upon by either party other than those expressly set forth herein.

14. This Agreement contains the entire agreement between the parties with respect to the subject matter hereof.

15. Notice under this Agreement will be sent to the parties at the following addresses:

Mr. Herb Bollman
F&H Transport
520 Terminal Avenue
New Castle, DE 19720

Jim Nertz, Esquire
WITCO Corporation
One American Lane
Greenwich, CT 06831-2559

F&H TRANSPORT, INC. (SEAL)

Herbert R Bollman Pres F&H, this 21 day of Aug, 1995.
By Its Authorized Representative (Title)

WITCO CORPORATION (SEAL)

[signature], for Permittee this 25 day of August 1995.
By Its Authorized Representative (Title) Vice President, General Counsel and Corporate Secretary

CONRAIL®

Post-it™ Fax Note 7671	Date 8/23	# of pages ▶ 5
To Carol Sforza	From C.A.	
Co./Dept. LANGEN	Co. Conrail	
Phone #	Phone # 215 209 1694	
Fax # 201-794-0366	Fax #	

August 23, 1995

James A. Nortz, Esquire
Witco Corporation
One American Lane
Greenwich, CT 06831-2559

SUBJECT: WILMINGTON, NEW CASTLE COUNTY, DELAWARE
HALBY CHEMICAL SITE
Right of Entry

Dear Mr. Nortz:

Attached, for your records, is fully executed Temporary License Agreement dated August 23, 1995.

You may now proceed to schedule work by contacting J.L. McGlynn at (609) 231-2460. No work can begin until authorization is obtained from Mr. McGlynn.

Very truly yours,

Catherine A. Aldinger
Analyst - Technical Assistance
Environmental Quality
(215) 209-1694

Attachment

CC: J.C. Phillips, Jr., Esquire (via fax)
C. Sforza (via fax)
M. Sawyer (via fax)

CONSOLIDATED RAIL CORPORATION

TEMPORARY LICENSE AGREEMENT PERMITTING ENTRY ON PROPERTY

WHEREAS, the U.S. Environmental Protection Agency ("EPA") has issued an order pursuant to CERCLA § 106, 42 U.S.C. § 9606, directing Witco Corporation to investigate and remediate the Halby Chemical Site, in Wilmington, New Castle County, Delaware; and,

WHEREAS, Conrail is not subject to the aforesaid § 106 Order, but, in light of the Order, Witco must have access to Conrail's property; and,

WHEREAS, The Halby Chemical Site is bounded in part by property of Consolidated Rail Corporation; and,

WHEREAS, in connection with the work that Witco Corporation must complete pursuant to the order it must enter onto property of Conrail to perform environmental testing and remediation and to erect on Conrail's property a fence limiting access to the Site.

THEREFORE, intending to be legally bound **WITCO CORPORATION**, hereinafter called "Licensee", and **CONSOLIDATED RAIL CORPORATION**, a corporation of the Commonwealth of Pennsylvania, hereinafter called "**CONRAIL**", enter into this Agreement on this 23rd day of August, 1995.

1. PERMISSION, LOCATION AND ACCESS

Subject to the terms and conditions hereinafter set forth **CONRAIL** hereby grants a temporary license to Licensee, and/or its agent(s), to enter upon the property of **CONRAIL** adjacent to the Halby Chemical Site, (at the Terminal Avenue Junction on the New Castle Secondary, Mile Post 0± to Mile Post .7±) in Wilmington, New Castle County, Delaware, as shown on the site plan and/or maps attached hereto, for the purpose of conducting environmental testing, which may include test pits and soil borings, to determine the extent of contamination, and remediation thereafter. **CONRAIL** hereby agrees to the erection of a temporary fence, which will encroach on **CONRAIL** property, to restrict access to the alleged contaminated area. Upon completion of the investigation, if it is determined that the extent of contamination does not extend onto **CONRAIL** property and the necessary work can be completed without entry onto **CONRAIL** property, the fencing shall be removed from the **CONRAIL** property and relocated to the boundary of the Witco property.

2. LIABILITY

Licensee hereby releases and will protect, defend, indemnify and save harmless **CONRAIL** and its subsidiaries, and their officers, agents and employees, against all claims, liabilities, demands, actions at law and equity, judgments, settlements, losses, damages and expenses of every character whatsoever (hereinafter collectively referred to as "Claims") for injury (including death) sustained by the officers, agents and employees of **CONRAIL** and its subsidiaries, Licensee and any officers, agents and employees of Licensee, and all other persons whomsoever, and for damage to or loss or destruction of property of any kind by whomsoever owned, caused by, resulting from, arising out of, or occurring in connection with the entry or presence of Licensee and its officers, agents and employees on **CONRAIL** property or incidental to or appertaining thereto. As a result of any such claims, Licensee will assume at its own expense, on behalf of **CONRAIL** and its subsidiaries, and their officers, agents and employees, the defense of any such claims which may be brought against said parties and pay on behalf of said parties the amount of any settlement agreed upon, judgment that may be entered, and any other amounts assessed in connection therewith, plus all costs and expenses involved as aforementioned.

3. ENTRY UPON PROPERTY

Licensee shall notify **CONRAIL's** Engineer of Construction, who will be J.L. McGlynn, telephone number (609) 231-2460 at least 5 working days in advance before entering upon or starting any work upon **CONRAIL** property. Entry upon **CONRAIL** property will be permitted after this Agreement is signed, any charges due hereunder are paid and permission has been received from **CONRAIL's** Engineer.

4. CONRAIL OPERATIONS

All operations of Licensee shall be carried out in such a manner so as not to interfere with **CONRAIL** operations, **CONRAIL's** use of its property or the use of any **CONRAIL** facilities. If in the opinion of the Engineer, conditions warrant at any time, **CONRAIL** will provide flag service and protection at the expense of Licensee and Licensee will pay to **CONRAIL** the full cost and expense therefor.

5. CROSSING OR FOULING TRACK

In no event shall equipment or material be transported across **CONRAIL's** track or tracks without special permission and with advance notice of at least forty-eight (48) hours so that **CONRAIL** may arrange for the necessary flag protection at the expense of Licensee and Licensee will pay to **CONRAIL** the full cost and expense therefor. Such permission shall be obtained from the **CONRAIL** Engineer.

Licensee agrees not to enter upon or foul track until given signal to do so by a flagman.

6. CLEARANCES

All equipment working on or material in use upon the property of **CONRAIL** shall be kept at all times no less than twelve (12) feet from the nearest rail of any track, or as subsequently modified in writing by the **CONRAIL** Engineer. Licensee shall conduct its operations so that no part of its equipment shall foul an operating track, transmission, signal or communication line, or any other structure of **CONRAIL**.

7. RESTORATION OF PREMISES

Upon completion of the work, **CONRAIL's** property shall be left in a condition substantially similar to its condition prior to Licensee's entry on the property. This includes, without limitation, immediate restoration of any fences removed.

8. TERM OF LICENSE

CONRAIL reserves the right to revoke this Agreement upon thirty (30) days written notice to Licensee. Licensee shall notify the Engineer when use of the property or work is completed, and this Agreement shall expire upon completion of the work, or on August 20, 1996, whichever is first. Under no circumstances shall this Agreement be construed as granting Licensee any right, title or interest of any kind or character in or about the land or premises of **CONRAIL**.

9. INSURANCE

Licensee shall pay to **CONRAIL** the sum of **One Hundred Ten ($110.00) for Railroad Protective Liability Insurance** coverage on behalf of the Licensee.

10. TITLE TO ENVIRONMENTAL STUDIES

The results of all tests conducted by Licensee on **CONRAIL's** property pursuant to the terms of this Agreement, including any and all reports and analysis obtained or compiled by the Licensee, regarding such tests, shall be promptly furnished to **CONRAIL**. Except for such disclosure as may be required by applicable federal or state law, the results and reports from any environmental investigations respecting **CONRAIL's** property shall remain confidential.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed as of the date first above written.

WITNESS:

Jill Doherty

WITNESS:

L B McGhee

WITCO CORPORATION

BY: Dustan E McCoy

Dustan E. McCoy
Vice President, General Counsel and Corporate Secretary

CONSOLIDATED RAIL CORPORATION

BY: J D Conrad

APPENDIX F

RECENT PHOTOGRAPHS OF COVERED SOIL PILES GENERATED DURING THE USEPA REMOVAL ACTION

SITE INSPECTION REPORT

SHEET 1 OF 1

Langan
Engineering and Environmental Services, Inc.

PROJECT NUMBER: 2061601
PROJECT: Halby Chemical
LOCATION: Wilmington, DE

CLIENT: Witco

DATE: 10/30/95
TIME AT SITE:
WEATHER: 65° Clear

CONTRACTOR & EQUIPMENT:

PRESENT AT SITE: Paul McAndrew, Chuck McCusker

OBSERVATIONS, DISCUSSIONS, TEST RESULTS, etc. (cont'd):

10:50 - PM and CM arrive at site, enter process plant area. Pallets stored throughout site, one car parked in process plant area.

- PM and CM cover the three soil piles with polyethylene plastic sheeting and weight down plastic with boards, rocks, concrete and metal plates. Spikes are driven into soil around piles and rope is tied between spikes and over piles to further secure plastic sheet. Covered piles are photographed.
- PM and CM repair undermined section of silt fence in sump area. Gravel and soil used to fill in hole and bury bottom edge of silt fence. Repair is photographed.
- PM and CM leave process plant area, lock gate, and enter drainage ditch area. Cover soil berm at "willow tree" location with polyethylene sheet plastic to prevent erosion. Plastic is weighted and photographed. Leave ditch area, lock gate.

14:30 - PM and CM leave site.

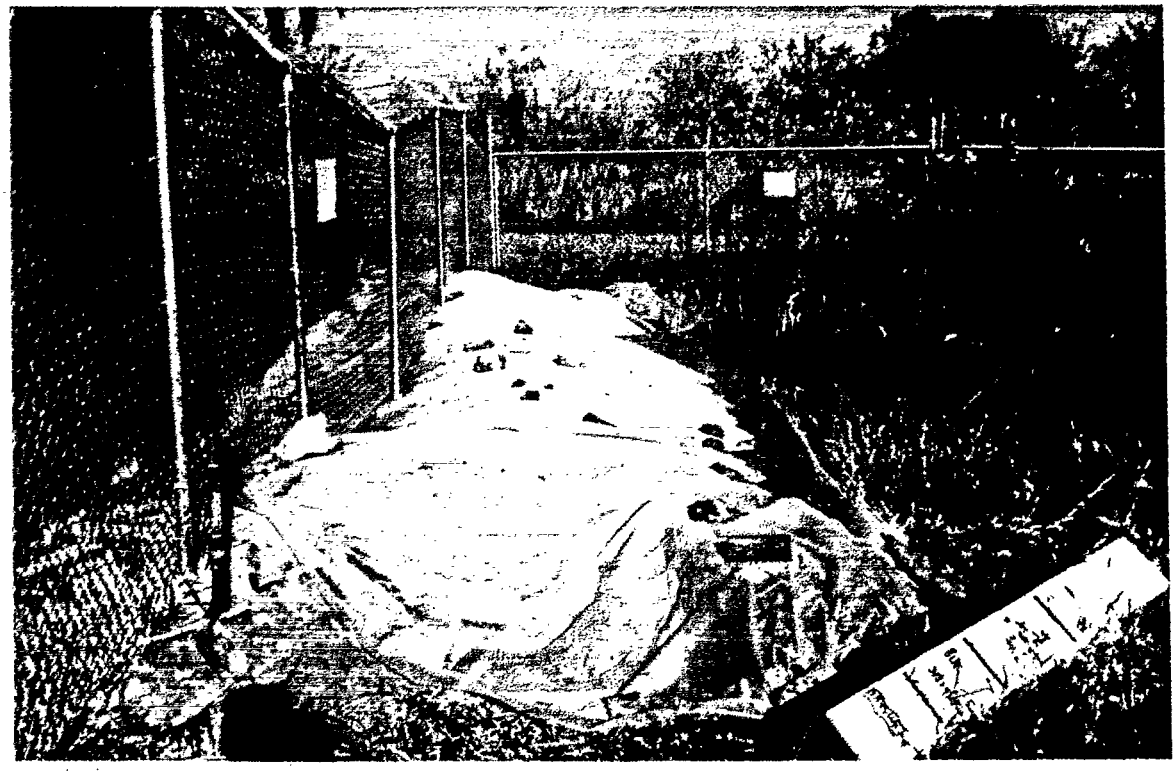
cc: B. Mercurio
C. Sforza

By: Paul McAndrew
Langan Engineering and Environmental Services, Inc.

Photograph No. 1. Recovered A1 soil pile

Photograph No. 2. Recovered #3 soil pile

Photograph No. 3. Repair of silt fence



Photograph No. 4. Temporary covering of berm

APPENDIX G

UNITED WATER CORRESPONDENCE

TRANSMITTAL

Langan
Engineering and Environmental Services, Inc.

RIVER DRIVE CENTER 1, ELMWOOD PARK, NEW JERSEY 07407 • (201) 794-6900 • FAX (201)794-0366

TO: United Water Delaware
2000 First State Blvd.
Wilmington, DE
19804-0508

ATTN: Theodore Harris Jr

DATE: July 13, 1995

PROJECT NO. 20616

RE: Halby Chemical

We Are Sending You Via:

- ☐ 1st Class Mail
- ☒ Federal Express
  - ☒ Priority
  - ☐ Standard
  - ☐ Two-Day
- ☐ Hand Delivery

The Following Items:

- ☒ Prints
- ☐ Letter
- ☐ Sepia
- ☐ _____

Copies	Drawing No.	Description
1 set		Originals
1 set		Reproducibles
2 sets		Copies
2 sets		Halby Maps

- ☐ For Your Information
- ☒ For Your Use
- ☐ As Requested by: _____
- ☐ For Review and Comment
- ☐ For Approval
- ☐ _____

REMARKS:

COPY TO:

BY:

Langan Engineering and Environmental Services, Inc.

Carol Stanger

Langan
Engineering and Environmental Services, Inc.

21 August 1995
2061601

United Water Delaware
2000 First State Blvd.
Wilmington, Delaware 19804-0508

Attn: Mr. Ted Harris

Re: Notification of Field Activities
Near Water Main
Halby Chemical Superfund Site
Wilmington, Delaware

Dear Mr. Harris:

As we discussed this morning, Langan Engineering and Environmental Services Inc. (Langan), on behalf of Witco Corporation, is planning field activities on the Halby Chemical Site, in response to an order from the United States Environmental Protection Agency (USEPA). The planned field activities include the installation of a fence and excavation of six test pits located adjacent to the water main.

The scope is defined in the attached documents:

- Bid Request for Work; and
- Site Security Plan.

The fence installation will start on the Brandywine Chemical Company property on 22 August 1995 and will be completed on Conrail property, as soon as Conrail access is received and Conrail engineers give their approval. Immediately following fence installation, six test pits will be excavated along the water main (also on Conrail property). Depths of the test pits will be 10 feet, and length will be approximately 8 feet.

As discussed, a United Water representative will be on the Halby Chemical Site on 22 August 1995 to mark out the remainder of the water line.

If you have any questions of need additional information, please call us at (201)794-6900.

Very truly yours,

LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Carole Sforza

Carole Sforza, P.G.
Project Manager

William F. Mercurio

William F. Mercurio, P.E.
Associate.

CS/WFM:hc
cc: Raj Vyas

20616harris.ltr

Langan
Engineering and Environmental Services, Inc.

MEMORANDUM

TO: BFL, WFM, CS, RYK

FROM: Larry Hoeger LSH

DATE: 12 September 1995

RE: Witco Halby
16" Water Main

Telephone conversations with Mr. Ted Harris of United Water Delaware on 1 September 1995 and the 5 September 1995 provided the following information regarding the 16" water main located along the eastern perimeter of the Halby Chemical site.

- The water main was installed in approximately 1962.
- The water main, referred to as the Atlas Line, transports 1.5 to 2.0 MGD.
- The line provides service to 8-9 users, the largest of which is ICI chemical. Mr. Harris will provide Langan with names and phone numbers of these users.
- Typical pipe lengths on this water main are 18 feet.
- The piping was wrapped with a "poly" material prior to installation.
- Copies of site plans providing the locations of shut off valves have been provided to Langan. These plans are not "as builts" and the valves are depicted in their approximate locations, "as builts" for this main do not exist.
- In the event of an accidental break of the water line United Water Delaware should be contacted immediately. The 24 hr. emergency phone number is (302) 633-5900. Mr. Ted Harris should also be contacted in the break occurs between the hours of 8:00 am - 4 pm at (302) 633-5905 ext. 328.
- United Water Delaware employees do not have 40 hour OSHA HAZWOPER training and cannot therefore perform the necessary repairs in the event of a break. The work must be performed by others.

- United Water Delaware does not currently have contingency plans governing water lines running through hazardous areas. Mr. Harris indicated that he had not yet encountered such a situation.

- Guardian Construction [(302) 834-1000] is a construction firm utilized by United Water Delaware to perform emergency repairs. Mr. Chuck Walter of Guardian Construction reported that his employees have 40 hour OSHA HAZWOPER training. Guardian also provides emergency spill response services to the states of Delaware, Maryland, and portions of Pennsylvania. Guardian has also performed demolition operations on the Halby site under the direction of the EPA. Prior to responding to any potential emergencies Guardian requests copies of site plans showing the locations of shutoff valves on the 16" water main.

20616 watermai mem

Langan
Engineering and Environmental Services, Inc.

13 September 1995
2061601

Mr. Raj Vyas
Witco Corporation
One American Lane
Greenwich, CT 06831

Re: Minutes from Meeting with United Water
Halby Chemical
New Castle, Delaware

Dear Mr. Vyas:

The following is a summary of the site visit and meeting held on 12 September 1995 between Mr. Ted Harris of United Water, Mr. Art Shapiro of Republic Environmental Systems (Republic), William Mercurio, Robert Koto and Charles McCusker of Langan Engineering and Environmental Services, Inc. (Langan).

- United Water, Republic and Langan personnel met at the Halby Chemical site at 1000 hours.
- Inspected valve boxes for the water line.
- Valve for the line to the south of the site is submerged in water within the valve box, it's location is shown by the intersecting point between two spray painted lines on the ground surface.
- The valve box for the valve to the north of the property is dry and accessible.
- It will take 205 turns to shut down the line. An electric valve wrench will be needed to shut down the line.
- Personnel left site at 1100 hours and traveled to the United Water Christiana Yard.
- Directions to the yard are as follows:

  Take I-495 south to I-95 south to Route 1 south to Route 273 west towards Newark. At the 2nd light turn left to Old Baltimore Pike. At the 1st light turn left into Rain Tree Village to the stop sign and turn right and go to the end of the road.

- While at the Christiana Yard, pipe, couplings, gaskets, nuts and bolts were inspected.
- At 1150 hours personnel traveled to the United Water Office in First State Industrial Park.

1970 CELEBRATING 25 YEARS 1995

- While at the United Water Office, all items of concern were discussed pertaining to the water line.
- United Water needs two to three days notice prior to the activity.
- Necessary equipment and personnel will be on standby during the digging.
- Ted Harris (United Water) is unaware what, if anything, the pipe might wrapped be with.
- Langan mentioned that the covering (if present) will need to be removed for testing by the corrosion experts and they will specify what will be used to cover the pipe when they are done testing.
- The pipe testing is to determine the pipe's integrity and thickness.
- William Mercurio (Langan) inquired as to what if any breaks or failures had occurred in the line. He was informed by Ted Harris that somewhere south of the site a contractor had broken the line while excavating and north of the site the pipe had broken due to a surge in the line.
- A list of users on the line was provided to Langan by United Water. The users included Diamond State Terminal, American Minerals, Autoport, Inc., Laidlaw Corp., DuPont Co., Power Services, Inc., Delaware Solid Waste Authority, and SPI-Polyols, Inc.
- Dave Beattie of ICI Specialties was contacted at (302) 427-1463 and spoke with William Mercurio in regard to the water line situation. Mr. Beattie mentioned that they are not using large quantities of water right now due to the drought and that they had a 300,000 gallon AST and an alternate source of water. He mentioned that in case of an Emergency the Power House Operator should be contacted at (302) 427-1487, there is someone there 24 hours a day.
- Other issues were discussed briefly, including who's decision it is to shut off the water main, what constitutes a clean corridor for the water main, and contingencies should contamination enter the pipeline from a breach of the water main.

If you should have any questions or comments feel free to contact me at (201) 794-6900.

Very truly yours,

LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

William F. Mercurio

William F. Mercurio, P.E.
Vice President

WFM:gr
20616:minutes.ltr
cc: William F. Mercurio
Robert Y. Koto
Carole Sforza
Charles McCusker
Edward Zofchak

APPENDIX H

RISK ASSESSMENT

Environmental
Resources
Management, Inc.

855 Springdale Drive
Exton, Pennsylvania 19341
(610) 524-3500
(610) 524-7335 (fax)

14 November 1995

Mr. Eric Newman
USEPA
DE/MD Remedial Section (3HW42)
841 Chestnut Street
Philadelphia, PA 19107

ERM

Re: Review of Constituent of Concern Toxicity
Halby Chemical Superfund Site

Dear Mr. Newman:

By this letter and the enclosed "Halby Chemical Site Review of Constituent of Concern Toxicity" (Report), Environmental Resources Management, Inc. (ERM) is providing, on behalf of Witco Corporation, a response to Item 8.3g of the 20 July 1995 USEPA CERCLA §106 Order (Order) issued to Witco for the referenced site. This item requires Witco to "Develop and submit for approval, soil clean-up level(s) sufficient to protect human health and the environment."

If you have any questions on this matter, please call Raj Vyas of Witco at 203-552-2476.

Sincerely,

Richard J. Dulcey, P.E. CHMM
ERM Project Manager

cc: Raj Vyas
Jane Biggs-Sanger
Robert Root
Patricia Miller, Esq (3RC22)
Michael Towle (3HW31)
James A. Nortz, Esq.
William F. Mercurio

enclosure

REPORT

Witco Corporation

Halby Chemical Site Review of Constituent of Concern Toxicity

14 November 1995

Environmental Resources Management, Inc.
855 Springdale Drive
Exton, Pennsylvania 19341

INTRODUCTION

On 20 July 1995, USEPA Region III issued to Witco Corporation a CERCLA §106 Order (Order) for certain removal activities at the Halby Chemical Site, Wilmington, Delaware (Site). Witco has retained Langan Environmental to perform investigation activities pursuant to the Order, and Environmental Resources Management (ERM) to provide support on certain issues. Order Item 8.3g requires Witco to "Develop and submit for approval, soil clean-up level(s) sufficient to protect human health and the environment."

This document presents risk-based concentration screening levels (RBCs) in response to Item 8.3g. This evaluation is preliminary in that the approach used herein is to develop generic Site Screening Levels (SSLs) to gauge the risk posed by the site constituents. The technical approach used is consistent with the methods CH_2MHill applied for the Operable Unit 2 (OU2) Risk Assessment. However, this evaluation does not represent a risk assessment comparable to that required for an RI/FS. Such an evaluation will either be addressed in EPA's final RI/FS for OU2, or as a future activity under the Order. For example, considering that no one is using site ground water, and the ground water contamination is well understood, no imminent threat appears to exist for ground water. Nonetheless, additional information to evaluate the soil to ground water pathway will be collected in the future.

Based on the previous investigation of the site by EPA, and the investigative work to date by Witco, the constituents which appear to drive the risk are arsenic, carbon disulfide, manganese, and thiocyanate. In fact, the risk assessment conducted by CH_2MHill attributed over 90% of the non carcinogenic risk to these compounds and the majority of the carcinogenic risk. Each of these constituents is addressed separately herein. Risk levels for different scenarios are presented for each constituent.

The information presented in this document uses typical USEPA default values for exposure by various receptors (attached as appendix). We recognize that these values are very conservative and reserve the right to modify (using current sound scientific principles) these values in any future risk assessment activities. In addition, the calculations have been completed with an assumption that the chemical substances are 100% absorbed from a soil matrix, and we also reserve the right to modify this assumption based on sound science in any future activities.

It should be noted that according to the Draft Soil Screening Guidance (we recognize the draft nature of this document) which EPA provided with their 20 October 1995 review of the Response Action Plan, SSLs can be set at a hazard index (HI) of 1.0 for chemicals with different endpoints. The HI is the standard measure of risk for noncarcinogenic constituents. Considering that the SSLs are based on Reference Doses which are typically set to be protective of the most sensitive populations, using an HI of 1.0 in such a manner is reasonable and conservative. Therefore, we have applied this HI value for each constituent since they each have different target organs for toxicity.

The values developed herein also use the default or site specific values for soil characteristics, etc. used in the CH_2MHill RA. For this evaluation, this is believed to be adequate. More site specific information gathered from the RAP should be used in a final RA for the site.

1.0 *ARSENIC*

A great deal of controversy surrounds the current health effects of arsenic. Arsenic is a naturally occurring metalloid that can occur in a number of different chemical forms. It is found in the earth's crust at an average level of 2 ppm, with background levels ranging from about 1 to 40 ppm. There are also several studies that indicate that low levels of arsenic are beneficial or essential for normal growth and development. EPA has stated that the daily requirement probably lies between 10 and 50 ug/day. The normal diet usually provides about 50 ug/day.

There is general appreciation for the fact that arsenic can cause lung cancer when inhaled, and EPA has classified arsenic as a class A constituent (a human carcinogen). EPA has determined a unit risk of 4.3×10^{-3} per ug/M^3. This unit risk factor is developed from occupational studies conducted in the early 1980s. However, there is no uniformity of opinion on the carcinogenicity of arsenic by oral administration. Some studies indicate that skin cancer has developed in individuals exposed to high oral arsenic. The primary study supporting this hypothesis involved a number of Taiwanese exposed to high arsenic in well water used for drinking purposes. EPA has used the Taiwanese study to develop a unit risk of 5×10^{-5} per ug/L. However, the EPA administrator, in a memorandum dated 6/21/88, counsels that "in reaching risk management decisions in a specific situation, risk managers must recognize and consider the qualities and uncertainties of risk estimates. The uncertainties associated with ingested inorganic arsenic are such that estimates should be modified downwards as much as an order of magnitude, relative to risk estimates associated with most other carcinogens. "

Part of the controversies surrounding the oral carcinogenic evaluation is the use of the Taiwanese study. For one, there are other areas in the world with high arsenic levels in drinking water that do not show a corresponding incidence of skin cancer. In addition, there is a concern that the Taiwanese population had lower nutritional status than the US population, and that based on some proposed mechanisms of action for arsenic, the health effects would be exacerbated in the presence of low nutrition.

There is also an oral reference dose (RfD) for arsenic 0.0003 mg/kg-day based on the same Taiwanese study but the end point is hyperpigmentation and keratosis following arsenic in drinking water. The No Observed Adverse Effect Level (NOAEL) was determined to be 0.009

mg/L which is converted to a dose of 0.0008 mg/kg-day. An uncertainty factor of 3 is applied to develop the RfD. The IRIS database contains the following note "There was not a clear consensus among Agency Scientists on the oral RfD. Applying the Agency's RfD methodology, strong scientific arguments can be made for various values within a factor of 2 or 3 of the currently recommended RfD value, i.e. 0.1 to 0.8 ug/kg/day. It should be noted, however, that the RfD methodology, by definition, yields a number with inherent uncertainty spanning perhaps an order of magnitude. New data that possibly impact on the recommended RfD for arsenic will be evaluated by the work group as it becomes available. Risk managers should recognize the considerable flexibility afforded them in formulating regulatory decisions when uncertainty and lack of clear consensus are taken into account."

Several studies on arsenic bioavailability from soil indicate that only a fraction of the arsenic contained in soil is absorbed into the body. A conservative value based on these studies is 28% of the arsenic is absorbed, and this absorption factor should be added to the calculation of dose. In addition, up to 90% of ingested arsenic is detoxified by methylation. The methylation reaction is a saturable enzyme above about 200 ug/day; however the maximum arsenic in surface soil or sediment 0-12") outside OU-1 at the Halby site (3110 mg/kg at SED08A) would result in a maximum internal dose of approximately 174 ug/day (based on 3110 mg/kg x 200 mg of soil ingested x 28 % absorption). Therefore, up to 90% of the ingestion arsenic would be expected to be methylated upon ingestion and not contribute to the body burden or to any toxic effects. Accordingly, the bioavailable fraction of arsenic in soil is less then 3% (based on only 28 % absorption and 10% non-methylated, or 1 x .28 x .1 = 0.03). The bioavailable fraction is defined as the fraction that will be absorbed into the body and contribute to the body burden. Calculation of a residential carcinogenic risk associated with a soil level of 300 mg/kg of arsenic and a 30 year exposure to 100 mg/day of soil, would result in a lifetime average daily dose of 5.5×10^{-6} mg/kg-day, and a carcinogenic risk of 1×10^{-5}. A similar calculation for the trespasser scenario at 8,000 mg/kg of arsenic in soil, would result in a lifetime average daily dose of 5.4×10^{-6} mg/kg-day, and a carcinogenic risk of 1×10^{-5}. These are both within the mid-point value of the National Contingency Plan guideline of 1×10^{-6} to 1×10^{-4} risk, and are therefore acceptable. In fact, based on these assumptions the soil level would have to be an order of magnitude higher (i.e., 3000 mg/kg for a resident) to exceed the 1×10^{-4} risk level.

Using a similar approach and a 1×10^{-5} risk level, acceptable levels for arsenic in soil were calculated to be 1000 mg/kg for the site worker and over 70,000 mg/kg for the construction worker.

2.0 CARBON DISULFIDE

Controversy also surrounds the current toxicity values for carbon disulfide. This chemical is highly volatile and most exposures are expected to occur through inhalation. In fact, carbon disulfide does not readily bind to soil and is expected to evaporate from surficial soils; however, it is also highly mobile and can migrate through soil into ground water. The most sensitive toxicological endpoint on chronic administration is thought to involve the nervous system. Specifically, occupational studies of workers chronically exposed to carbon disulfide concentrations of greater then 20 ppm in air, result in reduced nerve conduction velocity and polyneuritis. In addition, there are indications in both human and animal studies that carbon disulfide can produce reproductive and developmental effects in the offspring when exposed before or during pregnancy.

Oral exposure to carbon disulfide in soil is not very likely (due to the high volatility of carbon disulfide) and only limited oral studies are available in animals. Human workers are known to be dermally exposed to carbon disulfide, although the reported health effects are local (i.e. skin) rather than systemic. The body is expected to absorb carbon disulfide readily from all exposure routes, and due to it's lipophilicity, distribute primarily to the brain and liver. In the liver, carbon disulfide is readily metabolized to thiocarbamates, carbonyl sulfide and sulfur. The thiocarbamates are considered at least partially responsible for the neurotoxic effect of carbon disulfide.

EPA has developed an oral RfD of 0.1 mg/kg-day, based on an inhalation study in rabbits. These animals, exposed to 20 ppm and greater of carbon disulfide during gestation resulted in fetal toxicity and malformations. The NOAEL was determined to be 11 mg/kg-day. Application of uncertainty factors of 100 resulted in the oral reference dose. It should be pointed out that this is an inhalation study and not an oral study. In addition, the IRIS database includes the following note: "The oral RfD for carbon disulfide may change in the near future pending the outcome of a further review now being conducted by the oral RfD Work Group." This note has been on the database since February 1, 1989.

EPA has recently (August 1, 1995) developed a new inhalation RfC of 0.7 mg/M^3. This value was developed from occupational studies that indicated neurological effects in workers exposed to carbon disulfide. It was determined that the benchmark concentration for this study was 19.7 mg/M^3, and uncertainty factors of 30 were applied to develop the RfC

This RfC can be converted to an inhalation RfD of 0.2 mg/kg-day. This is in contrast to the earlier inhalation RfD of 0.00283 mg/kg-day (it is this latter value that was used in the Halby risk assessment).

There is no indication that carbon disulfide has any carcinogenic potential and is not considered a carcinogen by any regulatory agency.

Risk Based Concentrations (RBCs) were calculated for surface soil and carbon disulfide in the risk assessment. These values for the various receptors and some scientifically sound alternatives are presented in the following table:

COMPARISON OF ALTERNATIVE RBCS FOR CARBON DISULFIDE (mg/kg in soil)

	Halby RA	RfD_I New[a]	HI of 1.0[b]	65 days/yr[c]	10 days/yr[d]
Construction Worker	4.9	295	2,945	11,000	73,600
Site Worker	4.9	345	3,450		
Trespasser	180	8,400	84,000		
Future Child	3	170	1,700		
Future Adult	16	650	6,500		

[a]Application of the new USEPA inhalation RfD for carbon disulfide

[b]Application of a Hazard Index of 1.0

c For construction worker assume only 65 days per year (i.e. 5 days per week in summer) and a hazard index of 1.0

[d]Assume construction is only for 2 week period and a hazard index of 1.0

As shown by this comparison, if the current RfC for carbon disulfide were used, the RBCs would be increased significantly. Likewise, if the HI of 1 is, used rather than 0.1, then the RBCs would again be increased. Lastly, if the appropriate f_{OC} and area of the contamination were included, the RBC would be further increased. However, these factors have not been included herein. In addition, if the risk assessment focused on reasonable future use scenarios, (i.e. industrial) then the worker and trespasser would be the only relevant receptors. A separate construction worker scenario was prepared to define short-term risks during subsurface intrusive activities.

3.0 *MANGANESE*

Manganese is an essential element in every animal species studied. The recommended daily intake for manganese is between 2 and 5 mg, and the normal diet provides between 2 and 3 mg/day. The World Health Organization (WHO) has reported that no adverse effects occur in humans consuming 8-9 mg/day (0.11-0.13 mg/kg-day). EPA has previously developed two different oral RfDs for manganese, one for water of 0.005 mg/kg-day and one for food of 0.14 mg/kg-day. The lower RfD for water was based on an assumption that the bioavailability of manganese in water would be greater. In addition, this value assumes a normal dietary intake of manganese. The Environmental Criteria and Assessment Office (ECAO) has recently recommended that the water RfD be dropped and the food RfD be used for all risk evaluations. This change is due to an August 1994 workshop where the original Greek study, upon which the water RfD was based, was questioned, and it was reported that the bioavailability of manganese was found to be similar for both water and food. This change is expected to be officially revised in the Integrated Risk Information (IRSI) database shortly.

There is no indication that manganese has any carcinogenic potential and is not considered a carcinogen by any regulatory agency.

The risk assessment for the Halby site frequently applied the water RfD for development of RBCs, even soil, where it would have been more appropriate to use the food RfD (i.e. absorption of manganese from soil would more closely approximate absorption from food than from water). Some of the RBCs developed in the risk assessment and some scientifically sound alternatives are shown in the following table:

COMPARISON OF ALTERNATIVE RBCS FOR MANGANESE (mg/kg in soil)

	Halby RA	with RfD(food)[a]	with HI=1[b]	65 days/yr[c]	10 days/yr[d]
Construction Worker	1,900	1,900	19,000	71,000	465,000
Site Worker	4,00	4,200	42,000		
Trespasser	28,000	28,000	280,000		
Future child	39	810	8,100		
Future Adult	365	5,220	52,200		

[a] Application of correct oral reference dose

[b] Application of hazard index of 1.0

[c] For construction worker assume only 65 days per year (i.e. 5 days per week in summer) and a hazard index of 1.0

[d] Assume construction period is a total of two weeks in a year and a hazard index of 1.0.

Obviously, application of the correct RfD would increase the RBCs for both receptors, and application of the correct hazard index would further increase the RBCs in soil. Lastly, if the risk assessment focused on reasonable future use scenarios, (i.e. industrial) then the worker and trespasser would be the only relevant receptors, with even higher allowable concentrations for those receptors.

4.0 *THIOCYANATE*

The provisional RfD for thiocyanate was developed, according to the Halby Risk Assessment from a 10 week rat study with a LOAEL of 52 mg/kg-day. The risk assessment applied uncertainty factors totaling 3,000 to develop a provisional RfD of 0.02 mg/kg-day. The basis of this provisional RfD is not available for review, but this would appear to be an unnecessarily low RfD. Many of the cyanide compounds have oral RfDs in the 0.02 to 0.1 mg/kg-day range, and the main mechanism of detoxication for cyanide is the metabolism to thiocyanate, which is much less toxic. In fact, the RfD for sodium cyanide, which is 0.02 mg/kg-day includes a combined uncertainty-modifying factor of only 500. Therefore, since thiocyanate is less toxic than cyanide, and since it is a metabolite of cyanide that is easier to excrete, it is illogical that it have the same RfD as sodium cyanide. In fact, if the same uncertainty factor as used for sodium cyanide were applied (i.e. 500) then the RfD would by 0.1 mg/kg-day, the same value as the least toxic cyanide compound.

Other studies have reviewed the toxicity of thiocyanate in human studies and concluded that "the low end of the range for toxic effects in humans was somewhere between 1.4 mg/kg/day, at which toxic effects were considered "untoward but not alarming" and 13.9 mg/kg/day (Anderson and Chen, 1940)" Since these were human studies, EPA methodology would include only an uncertainty factor of 3 to account for the sensitive part of the population, resulting in an RfD of 0.5 mg/kg/day. As a somewhat more conservative evaluation, alternative RBCs are presented in the following table using the RfD of 0.1 mg/kg/day:

COMPARISON OF ALTERNATIVE RBCS FOR THIOCYANATE (mg/kg in soil)

	Halby RA	Alternative RfD[a]	HI= 1[b]	65 days/yr[c]	10 days/yr[d]
Construction Worker	430	2,100	21,290	82,000	532,000
Site Worker	1,500	20,400	204,000		
Trespasser	4,800	24,000	240,000		
Future Child	150	800	7,800		
Future Adult	1,400	7,300	73,000		

[a] Application of alternative RfD of 0.1 mg/kg-day

[b] Application of hazard index of 1.0

[c] For construction worker assume only 65 days per year (i.e. 5 days per week in summer) and a hazard index of 1.0

[d] Assume construction period is a total of two weeks in a year and a hazard index of 1.0.

As can be seen, if the alternative RfD were utilized, the RBC for thiocyanate in soil would increase markedly. Also, if a hazard index of 1.0 were used the RBC would be further increased. If the human derived RfD of 0.5 mg/kg/day were used, the numbers in the above table would be increased 5-fold. Again the appropriate receptors for this site would be the site worker and trespasser.

5.0 CONCLUSIONS

The appropriate receptors for the Halby site at the present time are the construction worker and trespasser. For longer term evaluation, the site worker is also included. Incorporating the current toxicologic information discussed herein, but retaining an individual Hazard Index of 1.0 and a 1×10^{-5} carcinogenic risk, the following RBCs would apply:

RECOMMENDED RBCs (mg/kg in soil)

	Arsenic	Carbon Disulfide	Manganese	Thiocyanate
Construction Worker	70,000	74,000	465,000	532,000
Trespasser	8,000	84,000	280,000	240,000
Site Worker	1,000	3,450	42,200	204,000

The application of these RBCs should consider the likely exposure scenarios. For the construction worker, exposure could occur to either surface or subsurface soils. Therefore, the maximum concentration of all soils should be compared to the RBCs for the construction worker. For the trespasser and site workers, the only probable exposure would be to surficial soils.

A review of the data shows that no soils exceed the RBCs for manganese or thiocyanate. Only a few small areas listed in the following table exceed the RBC for arsenic or carbon disulfide. Many of these samples are in sediment areas where they are even less accessible than soils. It should be noted that none of these samples are adjacent to the water line.

Identified Concentrations above RBCs (mg/kg in soil)

	Arsenic			Carbon Disulfide		
	Location	Concentration	Depth	Location	Concentration	Depth
Subsurface or Surface (Construction Worker)	–	–	–	HAS-5B	98,000	8"-12"
	–	–	–	HCS-15	107,000	7.5'-8.5'
	–	–	–	HCS-8	110,000	4'-4.5'
Surficial (Trespasser)	– No Concentrations Exceed RBCs –					
Surficial (Site Worker)	SED-05A	2,980	3"-12"	HAS-2A	8,600	0-1.5'
	SED-06	1,180	0-3'	HCS-3	5,900	0-6"
	SED-08A	3110	3"-12"	SED-03A	3,900L	3"-12"
	SED-24C	1,400	6"			
	HAS-6A	1010	1'			
	SSS-09	1130	3"-15"			

Note: L = Indicates concentration value is biased low.

APPENDIX

Calculation of risk based concentrations for noncarcinogens and carcinogens follows the methodology as presented in the CH_2MHill risk assessment and is presented in the following equations:

NONCARCINOGENS

$$RBC\ (mg/kg) = \frac{THI \cdot BW \cdot AT_{nc} \cdot 365\ days/year}{EF \cdot ED \cdot [((1/I_{ng}RfD) \cdot 1E^{-6} kg/mg \cdot I_{ng}R) + ((1/I_{nh}RfD) \cdot I_{nh}R \cdot ET \cdot (1/VF + 1/PEF))}$$

CARCINOGENS

$$RBC\ (mg/kg) = \frac{RISK \cdot BW \cdot AT_{c} \cdot 365\ days/year}{EF \cdot ED \cdot ((OSF \cdot 1\ E^{-6} mg/kg \cdot I_{ng}R) + (ISF \cdot I_{nh}R \cdot ET \cdot (1/VF + 1/PEF))}$$

		Trespasser	Site Worker	Future Child	Future Adult	Construction Worker
BW	Body Weight (kg)	34	70	15	70	70
AT_{nc}	Non-carcinogen Averaging Time (years)	4	25	6	24	1
AT_c	Carcinogen Averaging Time (years)	70	70	70	70	70
EF	Exposure Frequency (days/year)	52	250	350	350	250[a]
ED	Exposure Duration (years)	4	25	6	24	1
$I_{ng}R$	Ingestion Rate (mg/day)	100	50	200	100	480
$I_{nh}R$	Inhalation Rate (M^3/hr)	0.7	2.5	0.62	0.83	2.5
ET	Exposure Time (hours/day)	1.8	8	8	8	8
PEF	Particulate Emission Factor (M^3/kg)	6.79×10^8	6.79×10^8	6.79×10^8	6.79×10^8	6.79×10^8
THI	Target Hazard Index	1	1	1	1	1

[a]calculated alternative exposure frequencies of 65 days and 10 days.

CHEMICAL SPECIFIC INFORMATION

	VF	OSF (kg-d/mg)	ISF (kg-d/mg)	$I_{ng}RfD$ (mg/kg/d)	$I_{nh}RfD$ (mg/kg/d)
Arsenic	NA	1.75	15	0.0003	NA
Carbon disulfide	3340	NA	NA	0.1	0.2
Manganese	NA	NA	NA	0.14	0.0000143
Thiocyanate	NA	NA	NA	0.1	0.1

NA not available

VF - Volatilization Factor

OSF - Oral Cancer Slope Factor

ISF - Inhalation Cancer Slope Factor

$I_{ng}RfD$ - Ingestion Reference Dose

$I_{nh}RfD$ -Inhalation Reference Dose

APPENDIX I

TREATABILITY STUDY

MEMORANDUM

TO: Bill Mercurio DATE: 11/7/95
Langan Environmental

FROM: Paul Fahrenthold
Fahrenthold & Associates, Inc.

Subject: Treatability Study Work Plan for Halby

The subject of this memo is "Work Plan". This is a gross overstatement. It is a technical memorandum which can be eventually shaped into a work plan for treatability of the soils and groundwater at the site.

Three topics are discussed herein: the nature of the chemicals to be found at the site, treatment technologies for groundwater and treatment technologies for soils. Some preliminary designs are provided for reference purposes only. Any remedial technology design will have to be designed by Langan or the equivalent to accommodate site characteristics. We, Fahrenthold & Associates, could provide process design should that be required.

Site Contaminants

Review of the process chemistry of the manufacture of thiocyanates indicates that a rather large number of contaminants can be expected to be present in soil and groundwater at the site. The following discussion addresses both the qualitative aspects of site contaminants (what is there) and the quantitative aspects as well (how much of what is there).

The literature indicates that the process used to synthesize thiocyanates is the reaction between carbon disulfide and ammonia. Hydrogen sulfide is a byproduct of the reaction. The initial compounds on the suspect list are these

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reaction and by-product materials. It gets more complicated from here onward.

The mechanism of synthesis of the thiocyanates is through the formation and decomposition of ammonium dithiocarbamate and trithiocarbamate. The initial product is ammonium dithiocarbamate, whose decomposition produces thiocyanate and hydrogen sulfide. The hydrogen sulfide enters into a further reaction with the dithiocarbamate to form trithiocarbamate. The trithiocarbamate can also be decomposed to thiocyanate forming more hydrogen sulfide.

It would be normal, therefore, to expect that in the soils and groundwater we would find dithiocarbamate and trithiocarbamate as well as the starting materials and hydrogen sulfide, the major by-product.

There are apparently some side reactions that occur in the synthesis process. The literature reports the possibility of poly carbon disulfide, a black tarry material. Other reports indicate that ammonium sulfide can react with more sulfur to form a polymeric form of ammonium sulfide. Further, we can expect to find that the isomeric form of thiocyanate, isothiocyanate, will also be present.

As we learn more about the Halby product mix we can supplement the following list of target chemicals.

carbon disulfide
ammonia
hydrogen sulfide
thiocyanate
ammonium dithiocarbamate
ammonium trithiocarbamate
poly carbon disulfide
poly ammonium sulfide
isothiocyanate

The extent to which any or all of these would be present in the environment surrounding the facility depends on how Halby ran their process for producing thiocyanate. The extent to which other chemicals would be found around the facility depends on other processes used and how they were carried out.

How the processes were carried out and what those processes were impacts more than just what chemicals are present. It affects the quantities of the materials present in the environment as well. Unfortunately, no estimates can be made as to the quantity of each defined contaminant by

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reviewing the process chemistry. For quantitative work flow diagrams and material balances are necessary.

Plant records usually contain material balances for the processes carried out and some flow diagrams that indicate how process materials were used. If you have access to these records we are well on our way to determining how much of what was used and how it was lost to the environment.

In the event such documentation on the Halby processes is available I would like to review it as one of the first steps in the treatability program. Such a review would allow us to determine if other compounds are present and to what extent each of them could be present. That information will help determine the quantity of residual compounds to be left at the site after optimum treatment, and if those levels are acceptable.

For now we will proceed with the information available.

Treatment Technology

In order to address treatment of the compounds listed above we need to categorize them according to their properties which are significant for responding to treatment processes.

It is clear that carbon disulfide and hydrogen sulfide are volatile, with hydrogen sulfide being a gas and carbon disulfide a low boiling liquid. These compounds must be treated, therefore, with technologies focused on emission controls for gases or control of volatiles.

It is also clear that since the thiocyanates are not volatile and are inorganic in nature that they will have to be removed through either concentration processes normally used for ions, e.g. ion exchange, RO, etc. or a destructive process such as UV or ozone oxidation, chlorine oxidation or biological treatment.

As should be obvious, most if not all of the chemical "signature" of the Halby site is not on the EPA's list of compounds of interest. Those "other" compounds are important, however, since they may provide a carbon source for the biodegradation of carbon disulfide or other organics yet to be identified in the soils and groundwater at the site. Any organic material in the soil or groundwater could contribute substantially to a biotreatment/soil remediation program for the site.

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Soil Treatment

Given the above categorization of the contaminants we can look at the medium where they are contained. First, we address volatile organics. In order to remove volatiles and gases from soils a vapor extraction system (VES) is normally used. In the current case, where we have soils above ground which will be stockpiled, the VES consists of a blower whose suction is connected to a series of perforated pipes installed in the stockpile. The stock pile is covered and must have vents or chimneys in the top and some type of vent around the edges to allow air to enter the pile. Under normal circumstances, i.e. those in which the permeability of the soil is moderate to high, the influence of a blower that will produce three inches of mercury vacuum is at least 10 feet radius around the perimeter of the suction line (exact calculations can be made for a final design). A sketch of a design is attached.

There are two consequences of using the VES to remove volatiles from the stockpile: the vapors/gases may need to be controlled and the entry of oxygen to the pile may create an oxidizing condition with the liberation of heat. First, we address control of the emissions. In the event gases which are non-condensable and non-adsorbable are produced they may require scrubbing with discharge of the water to the POTW. It is unlikely that treatment of scrubber water will be feasible. In the event it is required, another treatment unit will have to be designed for removal of the contaminants either recovered or formed in the scrubber. This discussion relates directly to the scrubbing of hydrogen sulfide with caustic and discharge of the scrubber water.

The other alternative is adsorption of the volatile or condensable compounds discharged through the VES. There are two types of adsorbents which are suitable for this application. They are Ambersorb® adsorbent manufactured by Rohm and Haas Corp. and Optipore®, produced by Dow chemical Co. They can be regenerated by steam, hot air or other technology. The selection of an adsorbent depends on the performance needed (emission limitations to be met) and the cost-capacity of the adsorbent. We have a proprietary technology for removal of volatiles from air streams that might work for this application. A flow diagram for the application is also attached for review.

The materials remaining in the pile are subject to biological degradation. In order to promote biodegradation we

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need to measure the nutrient levels present in the soils, i.e. nitrogen and phosphorous, and the available carbon (substrate). If these compounds are present at the prescribed ratios, then one need only provide a warm environment and adequate air for the bacteria present in the soils to metabolize the carbon using the nutrients available. In the event specialized bacteria are available the pile can be inoculated prior to commencing the biotreatment process.

The VES used to remove volatiles will simultaneously remove volatiles and aerate the pile, providing adequate oxygen for bacterial respiration.

Components of Treatability Study

From review of the above it appears that the applicable technologies for excavated soils are vapor extraction to remove volatiles, adsorption on a regenerable adsorbent to clean the air extracted with the VES, and biological treatment in the engineered pile for conversion of the organics such as thiocyanate, solvents (isooctyl alcohol, etc.), etc. which are in the soils.

The steps to evaluate these technologies for soil treatment are as follows:

1. Perform analyses of the excavated soils for the compounds listed above as well as nitrogen and phosphorous. There should be a couple of samples run by the TCLP procedure and the extract checked for conventional pollutants such as TOC, COD and maybe BOD. The analyses should also include the identification of the top 10 non-listed contaminants (search of mass spectrometer data base for best match).

2. A literature search should be undertaken to determine the degradability of the organics identified in the above analyses. A similar search should be made for information on the quantitative sorption capacity of commercial adsorbents for carbon disulfide and hydrogen sulfide.

3. A search of available plant records should be made to evaluate the processes which were carried out. We know that the facility manufactured thiocyanates from carbon disulfide and ammonia. Other products could have been produced there as ancillary to the main production lines. The presence of non-degradable of non-sorbable compounds could defeat treatment systems put in place. An evaluation of other potential contaminants is necessary to insure that no interferences will occur in treatment systems being evaluated.

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4. When the soil piles are moved/consolidated a perforated tube should be installed in the pile to allow for removal of carbon disulfide through vapor extraction and biotreatment. The design of the tube installation is shown on the attached sketch.

Groundwater Treatment

Using the inventory of site contaminants provided above, a candidate list of treatment technologies can be assembled. First, considering volatile organics such as carbon disulfide, they can be readily removed from groundwater through air stripping.

The off-gas from the stripper may require emission controls in which case the regenerable adsorbents used for the VES off-gas would likely be suitable.

For thiocyanate there are two potential removal processes. The first is ion exchange where the thiocyanate ion is adsorbed to a resin and removed with a concentrated solution of table salt or sodium hydroxide. Disposal or reuse of the regenerant solution is an important consideration in the use of this process operation.

The second choice is biotreatment. Since concentration levels of thiocyanate are expected to be low (in the ppm range), it would have to be removed through cometabolism with other organics in solution. The preferred system for biotreatment would be a submerged media device, designed to handle low food containing streams. The portion of organics to be degraded biologically (as quantified in the above TCLP tests where the extract would be analyzed for TOC) is a significant factor in the use of this style of biotreatment. Low concentrations of "other" organics might mean that this form of treatment is not appropriate.

Organic semi-volatiles which are degradable would also be removed in any biotreatment process.

The steps to be taken to evaluate technologies for groundwater are as follows:

1. Define the concentration ranges for all of the contaminants indicated to be present in groundwater through the analyses outlined above or others yet to be defined.

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2. Evaluate the literature for sorption of thiocyanate on resins and its biodegradability under various conditions.

3. Evaluate the literature for degradability of other organics which may be in solution in groundwater.

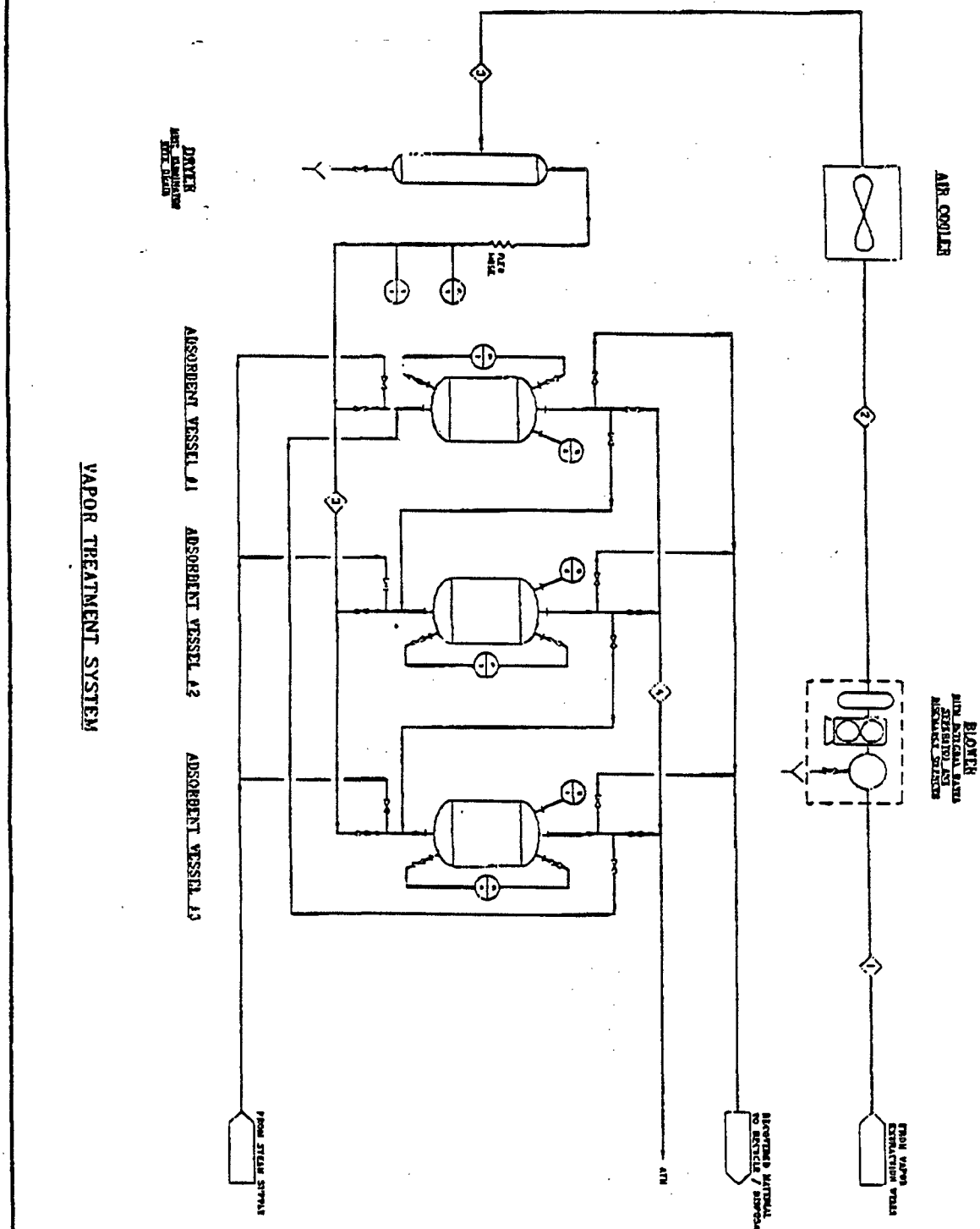
4. Evaluate Henry's Law constant for carbon disulfide and estimate the potential for air stripping it from solution.

Future Work on Treatability

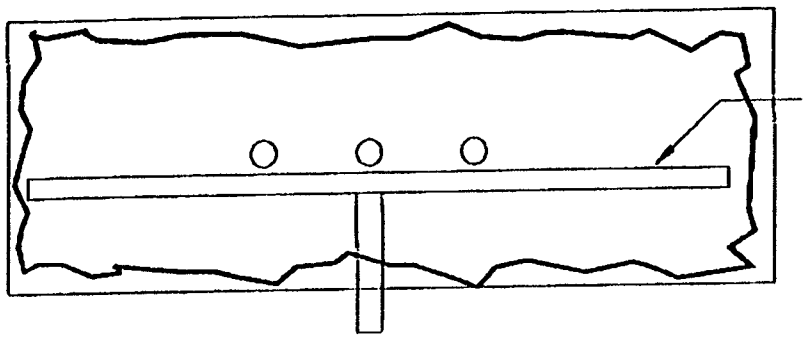
There is potential for pilot testing of the most attractive treatment options in the spring and summer of 1996 in a field program. At that point in time we should know the volume of soils to be treated and the quantity of groundwater to be remediated. These quantities are necessary to identify the most cost-effective treatment alternatives.

The details of a field pilot program will be defined after the results of the work proposed in this effort has been concluded.

Please call if you have questions.



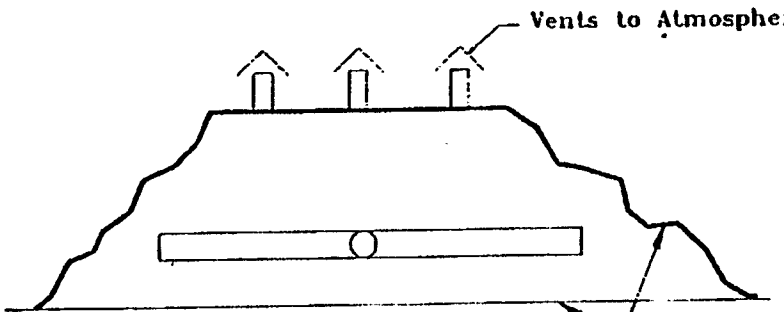
FAIRENTHOLD & ASSOCIATES, INC. 1470 ENEA CIRCLE, STE. H-1740 CONCORD, CA. 94520 510-933-4849	CARS[SM] TYPICAL VAPOR TREATMENT SYSTEM P. & I. D.



Internal VES Slotted Pipe
Capped on Ends
Packed in Gravel

Top of Pile

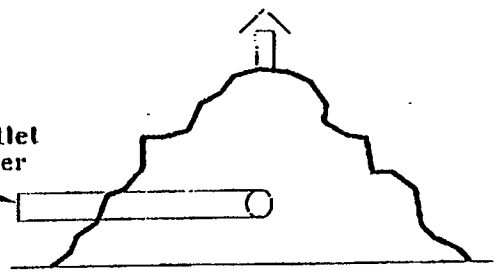
Use 3" PVC Pipe with
glued joints as default.
larger size may be required.
Blower may be 50-100cfm, 110VAC,
belt drive on vendor supplied
baseplate.



Vents to Atmosphere

Front of Pile

Put Contaminated Soil
on Liner and Cover
With Same Liner
Material



VES Outlet
to Blower

Right Side of Pile

REFERENCE DRAWINGS	REVISIONS	REVISIONS
NO. WHO	NO. DESCRIPTION BY DR. CHK APP	NO. DESCRIPTION BY DR. CHK APP

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